Teaching Plan 2025 -26

Shri. Swapnil B. Patil

BSc III Sem V

Immunology

Month	**Week**	**Topic covered**	**Teaching Method**
July	3	A) Cells and organs of the immune system: I) Cells of the immune system i. Haematopoiesis- Characteristics and Types of stem cells ii. Classification of cells of immune system- Lymphoid and myeloid cells	Lecture, Discussion
	4	iii. Structure and functions of Lymphoid cells- T cells and T cell subsets, NK cells, B cells and dendritic cells	Lecture, Discussion
August	1	iv. Structure and functions of myeloid cells – Granulocytes, Monocytes and macrophages	Lecture, Discussion
	2	II) Organs of the immune system Primary and secondary lymphoid organs - Structure and functions of Thymus, bone marrow, spleen, lymph node and Mucosa associated lymphoid tissue (MALT)	Lecture, Discussion
	3	B) Molecular mechanism of antibody production: i. Processing and presentation of antigen by Antigen presenting cell. ii. Interaction of APC with TH cell	Lecture, Discussion
	4	iii. Interaction of B cell and TH cell iv. Proliferation and differentiation of activated B cells v. Role of follicular dendritic cells in selection of high affinity B cells vi. Role of cytokines in proliferation and differentiation	Lecture, Discussion
September	1	C) Complement: i. Nature, Properties, Complement activation by classical and alternate pathway. ii. Biological consequences of complement activation	Lecture, Discussion

	2	D) Monoclonal antibodies: i. Concepts of Polyclonal and monoclonal antibodies ii. Production of mouse monoclonal antibodies by hybridoma technology.	Lecture, Discussion
	3	iii. Types of monoclonal antibodies- Mouse, Chimeric, Humanized and Human antibodies iv. Applications of monoclonal antibodies.	Lecture, Discussion
	4	A) Cytokines: i. General characters of cytokines ii. Cytokines produced by different TH cells and Macrophages. iii. Effects of cytokines	Lecture, Discussion
October	1	iv. Interferon–properties- types, inducers of Interferon, Mechanism of action- antiviral and immunoregulatory	Lecture, Discussion
	2	B) Hypersensitivity: i. Basic concept, Gell and Coombs classification ii. Type I-Anaphylaxis iii. Type II-Blood transfusion reactions iv. Type III-Serum sickness. v. Type IV- Delayed type hypersensitivity – Allergy of infection, Allograft rejection.	Lecture, Discussion
	3	C) Immunological tolerance and Autoimmunity: i. Immunological tolerance a) Natural or self-tolerance and induced tolerance b) Cellular mechanism of immunological tolerance- Central tolerance and peripheral tolerance c) Termination of tolerance	Lecture, Discussion
	4	ii. Autoimmunity: a) Concept b) Autoimmune diseases: Types, Immunopathological Mechanisms- Rheumatoid arthritis, Treatment of autoimmune diseases	Lecture, Discussion
November		Semester V Examination	

Teaching Plan 2025 -26

Shri. Swapnil B. Patil

BSc III Sem VI

Medical Microbiology

Month	**Week**	**Topic covered**	**Teaching Method**
December	2	BACTERIAL DISEASES Morphology, cultural and biochemical characteristics, antigenic structure, modes of transmission, pathogenesis, symptoms, laboratory diagnosis, prevention and control of diseases caused by i)*Mycobacterium tuberculosis*	Lecture, Discussion
	3	ii)*Clostridium perfringens*	Lecture, Discussion
	4	iii)*Treponema pallidum*	Lecture, Discussion
January	1	iv)*Pseudomonas aeruginosa* v)*Vibrio cholera*	Lecture, Discussion
	2	vi)*Staphylococcus aureus* vii)*Leptospira interrogans*	Lecture, Discussion
	3	viii)*Klebsiella pneumonia*	Lecture, Discussion
	4	A. Morphology, cultural and biochemical characteristics, antigenic structure, modes of transmission and pathogenesis, symptoms, laboratory diagnosis, prevention and control of diseases caused by 1) Protozoa: Plasmodium falciparum (malaria)	Lecture, Discussion
February	1	2) Viruses: i) Hepatitis A & B virus ii) Rabies virus iii)Dengue virus	Lecture, Discussion
	2	3) Fungus: *Candida albicans*	Lecture, Discussion
	3	B. Chemotherapy 1) Chemoprophylaxis 2) General principles of chemotherapy	Lecture, Discussion
	4	3) Mode of action of antimicrobial agents: a) Antibacterial drugs: Penicillin, Bacitracin, Piperacillin, cycloserine, Streptomycin, Tetracycline, Trimethoprim, Sulphonamides and Quinolones. b) Antiviral drug: AZT, c) Antifungal drugs: Ketoconazole, Griseofulvin, Nystatin d) Antiprotozoal drugs: Metronidazole, Mepacrine	Lecture, Discussion

March	1	4)Drug resistance: Reasons and Mechanism of drug resistance	Lecture, Discussion
	2	5) Immunoprophylaxis: Vaccines and Immune Sera	Lecture, Discussion
	3	a) Vaccines-live attenuated, inactive, subunit, conjugate and DNA vaccines b) Immune Sera- examples with applications	Lecture, Discussion
	4	Practical Examination	
April		Semester VI examination	

Teaching plan – 2025-26 Name of the faculty- Dr. Mrudula M. Bendigeri M. Sc. I – Sem I – Immunology			
Month	**Week**	**Topic covered**	**Teaching Method**
July	3	Structure, classes & biological activities of immunoglobulins	Lecture, Discussion
	4	Organization & expression of immunoglobulin genes	Lecture, Discussion
August	1	General Organization and Inheritance of the MHC	Lecture, Discussion
	2	MHC molecules, genes and genetic map	Lecture, Discussion
	3	Cellular distribution and regulation of MHC	Lecture, Discussion
	4	MHC immune responsiveness and disease susceptibility	Lecture, Discussion
September	1	Cytokines	Lecture, Discussion
	2	Complement system	Lecture, Discussion
	3	Leucocyte migration	Lecture, Discussion
	4	Inflammation	Lecture, Discussion
October	1	Transplantation immunology	Lecture, Discussion
	2	General and specific immunosuppressive therapy	Lecture, Discussion
	3	Vaccines and vaccination	Lecture, Discussion
	4	International standards of vaccines	Lecture, Discussion
November		EXAM	
M. Sc. I – Sem II – Fermentation Technology			
December	2	Basic functions of a fermenter	Lecture, Discussion
	3	Design of other fermentation vessels	Lecture, Discussion
	4	Sterilization of fermentation equipment, air and media	
January	1	Fermentation broth rheology and power requirements	Lecture, Discussion
	2	Fermentation media	Lecture, Discussion
	3	Fermentation economics	Lecture, Discussion
	4	Patents	Lecture, Discussion
February	1	Environmental and genetic control of metabolic pathways	Lecture, Discussion
	2	Growth and product formation	Lecture, Discussion
	3	Contamination problems in fermentation industry	Lecture, Discussion
	4	Computer applications in fermentation technology	Lecture, Discussion
March	1	Lactic starter culture and Vitamin- B12 fermentation	Lecture, Discussion
	2	Gluconic acid fermentation	Lecture, Discussion
	3	Distilled alcoholic beverages	Lecture, Discussion
	4	Bacterial vaccines	Lecture, Discussion
April		EXAM	

M. Sc. II – Sem III – Quantitative Biology			
July	3	Basic concepts of biostatistics, collection and presentation of data	Lecture, Discussion
	4	Descriptive statistics, probability, sampling methods	Lecture, Discussion
August	1	Inference about population	Lecture, Discussion
	2	Hypothesis testing	Lecture, Discussion
	3	ANOVA	Lecture, Discussion
	4	Correlation and regression	Lecture, Discussion
September	1	Basic concepts of bioinformatics	Lecture, Discussion
	2	Biological sequence databases	Lecture, Discussion
	3	Bioinformatics tools and applications	Lecture, Discussion
	4	Emerging areas in bioinformatics	Lecture, Discussion
October	1	Bioburden determination	Lecture, Discussion
	2	In process material bioburden determination	Lecture, Discussion
	3	Probability and HACCP	Lecture, Discussion
	4	Thermal Inactivation	Lecture, Discussion
November		EXAM	
M. Sc. II – Sem IV – Food and Dairy Microbiology			
December	2	Food as a substrate for Microorganisms, General principles underlying microbial spoilage of food	Lecture, Discussion
	3	Microbial spoilage of meat, fruits and vegetables, Microbial spoilage of heated canned food	Lecture, Discussion
	4	General principles and methods of food preservation	
January	1	Milk- definition , composition etc.	Lecture, Discussion
	2	Spoilage of milk and milk products	Lecture, Discussion
	3	Microbiology and biochemistry of fermented foods	Lecture, Discussion
	4	Fermented milk products	Lecture, Discussion
February	1	Food borne diseases	Lecture, Discussion
	2	Prevention and control of food borne diseases	Lecture, Discussion
	3	Fermented dairy products	Lecture, Discussion
	4	Fermented dairy products for gut health	Lecture, Discussion
March	1	Probiotics	Lecture, Discussion
	2	Enzymes in food processing	Lecture, Discussion
	3	Applications of enzymes	Lecture, Discussion
	4	Food safety and standards	Lecture, Discussion
April		EXAM	

Teaching Plan 2025 -26

Smt. Priya V. Patil

BSc III Sem V

Food and Industrial Microbiology

Month	**Week**	**Topic covered**	**Teaching Method**
July	3	Food as a substrate for microorganisms: Intrinsic and extrinsic factors	Lecture, Discussion
	4	Sources of microorganisms to food Food spoilage: spoilage wine and beer, spoilage of vinegar	Lecture, Discussion
August	1	General Principles and methods of food preservation	Lecture, Discussion
	2	Determination of: TDP, TDT, D, F, and Z values	Lecture, Discussion
	3	Food poisoning: Role of microorganisms in food poisoning	Lecture, Discussion
	4	Food poisoning: i) Staphylococcal ii) Fungal (aflatoxin)	Lecture, Discussion
September	1	Food infections: food infection: Salmonellosis.	Lecture, Discussion
	2	Probiotics: Concept and applications	Lecture, Discussion
	3	A) Strain Improvement B) Scale up of fermentations C) Microbiological assays	Lecture, Discussion
	4	Preservation of industrially important microorganisms: Methods & Culture collection centres.	Lecture, Discussion
October	1	Industrial production of: Alcohol: - Organisms used, Inoculum preparation, Fermentation media, Fermentation conditions, Extraction and Recovery.	Lecture, Discussion
	2	Grape wine: - Definition, types, production of table wine (Red and White) and microbial defects of wine	Lecture, Discussion
	3	Penicillin: - Organisms used Inoculum preparation, Fermentation media, Fermentation conditions, Extraction and Recovery. Concept of semi synthetic penicillin	Lecture, Discussion
	4	Downstream processing & product recovery: Centrifugation, flocculation, filtration, solvent extraction, distillation, precipitation, Crystallization and chromatography. D. Testing of sterility, pyrogen, carcinogenicity, toxicity and allergens	Lecture, Discussion
November		Semester V Examination	

Teaching Plan 2025 -26

Smt. Priya V. Patil

BSc III Sem VI

Microbial Biochemistry

Month	**Week**	**Topic covered**	**Teaching Method**
December	2	Enzymes - Definition, properties, structure, specificity, mechanism of action (Lock & Key, Induced fit hypothesis), Basics of enzyme classification.	Lecture, Discussion
	3	Allosteric enzymes - Definition, properties, models explaining mechanism of action (Concerted and sequential models). Patterns of feedback inhibition.	Lecture, Discussion
	4	Extraction and purification of enzymes. Methods of extraction of intracellular and extracellular enzymes. Choice of source and biomass development	Lecture, Discussion
January	1	Methods of homogenization - cell disruption methods Purification of enzymes on the basis of - a) Molecular size, b) Solubility differences c) Electrical charge, d) Adsorption characteristic differences e) Differences in biological activity	Lecture, Discussion
	2	Assay of enzymes - Based on substrate and product estimation. Ribozymes and Isozymes. Immobilization of enzymes - Methods and applications	Lecture, Discussion
	3	Factors affecting enzyme activity a) Factors affecting catalytic efficiency of enzymes- i) Proximity and orientation, ii) Strain and distortion, iii) Acid base catalysis, iv) Covalent catalysis	Lecture, Discussion
	4	Environmental factors influencing enzyme activity- i) Substrate concentration, ii) Temperature, iii) pH, iv) Metal ions	Lecture, Discussion
February	1	Kinetics of single substrate-enzyme catalysed reactions - Derivation of Michaelis-Menten equation, Lineweaver Burk Plot, Significance of Km and Vmax.	Lecture, Discussion
	2	Basics in carbohydrate metabolism a) PP pathway, ED pathway, Phosphoketolase pathway	Lecture, Discussion
	3	Pyruvate as a key intermediate c) Glyoxylate bypass	Lecture, Discussion
	4	Assimilation of - a) Carbon b) Nitrogen with respect to N2 and NH3 (GOGAT) c) Sulphur	Lecture, Discussion
March	1	Biosynthesis of – RNA DNA	Lecture, Discussion

	2	Proteins, Peptidoglycan	Lecture, Discussion
	3	Regulation of enzyme synthesis. Positive control - Ara operon, Negative control - Lac operon	Lecture, Discussion
	4	Catabolite repression	
April		Semester VI examination	

Teaching Plan 2025 -26

Smt. Priya V. Patil

BSc II Sem III

Microbial Physiology and Metabolism

Month	**Week**	**Topic covered**	**Teaching Method**
July	3	Growth: Growth phases	Lecture, Discussion
	4	Measurement of growth	Lecture, Discussion
August	1	Continuous growth	Lecture, Discussion
	2	Synchronous growth	Lecture, Discussion
	3	Diauxic growth	Lecture, Discussion
	4	Microorganisms at extreme environment and their strategies- Temperature, pH	Lecture, Discussion
September	1	Osmotic pressure	Lecture, Discussion
	2	Heavy metals	Lecture, Discussion
	3	Radiations	Lecture, Discussion
	4	Transport across cell membrane – Diffusion, active transport and group translocation	Lecture, Discussion
October	1	Catabolism of glucose - EMP, HMP	Lecture, Discussion
	2	ED and TCA cycle	Lecture, Discussion
	3	Fermentation –Homolactic & Heterolactic fermentation	Lecture, Discussion
	4	Bacterial electron transport chain –Components, flow of electrons & mechanism of ATP generation Chemiosmotic hypothesis	Lecture, Discussion
November		Semester III Examination	

Teaching Plan 2025 -26

Smt. Priya V. Patil

BSc II Sem IV

Applied Microbiology

Month	**Week**	**Topic covered**	**Teaching Method**
December	2	A) Air Microbiology: a) Sources of microorganisms in air. b) Definitions of - Infectious dust, Droplets & Droplet nuclei c) Sampling methods for microbial examination of air	Lecture, Discussion
	3	i) Solid impaction - Sieve device ii) Liquid Impingement – Bead-bubbler device	Lecture, Discussion
	4	B) Microbiology for potable water: a) Sources of microorganisms in water. b) Fecal pollution of water, Indictors of fecal pollution of water –*E. coli*	Lecture, Discussion
January	1	c) Routine Bacteriological analysis of water. 1) SPC & 2) Tests for coliforms -	Lecture, Discussion
	2	i. Qualitative-Detection of coliforms - Presumptive test, Confirmed Test, Completed test.	Lecture, Discussion
	3	Differentiation between Coliforms - IMViC test, Eijkman test. ii. Quantitative – MPN, Membrane filter technique	Lecture, Discussion
	4	d) Municipal water purification process and its significance.	Lecture, Discussion
February	1	C) Milk Microbiology: a) Sources of microorganisms in milk b) General composition of Milk. c) Microbiological examination of Milk – DMC, SPC and dye reduction test- MBRT test	Lecture, Discussion
	2	d) Pasteurization - Definition, Methods – LTH, HTST, UHT,	Lecture, Discussion
	3	Determination of efficiency of Pasteurization– Phosphatase test (Qualitative)	Lecture, Discussion
	4	A) Basic concepts of fermentation. 1. Definition, concept of primary and secondary metabolites 2. Types of fermentations – Batch, continuous, dual and multiple	Lecture, Discussion
March	1	3. Typical Fermenter design – Parts and their functions.	Lecture, Discussion
	2	4. Factors affecting fermentation process	Lecture, Discussion
	3	B) Screening - Primary and secondary screening	Lecture, Discussion
	4	C) Fermentation Media - Water, carbon source, nitrogen source, Precursors, growth factors, antifoam agents & chelating agents.	Lecture, Discussion
April		Semester VI examination	

Teaching Plan 2025 -26

Mrs. Priya V. Patil

M. Sc I Sem I

Microbial Systematics

Month	Week	Topic covered	Teaching Method
July	3	1.1 Species concept in prokaryotes and eukaryotes 1.2 Speciation concept	Lecture, Discussion
	4	1.3 5-Kingdom classification system	Lecture, Discussion
August	1	1.4. 3-Domain classification system 1.5. History and Approach of development of the Bergey's Manual, and its current status	Lecture, Discussion
	2	1.6. Polyphasic Approach 1.7. Molecular clocks, phylogeny and molecular distances	Lecture, Discussion
	3	2.1 Identification of microbes using conventional biochemical methods and genome-based tools.	Lecture, Discussion
	4	2.2 Nomenclature of microbes as per International Code of Nomenclature of Prokaryotes (ICNP)	Lecture, Discussion
September	1	2.3 Nomenclature of microbes as per the SeqCode. Details about Rule 30 and the reasons for developing the SeqCode 2.4 Discussion and debate from a purely taxonomic perspective on ICNP and SeqCode	Lecture, Discussion
	2	2.5 Concept of 'List of Prokaryotic names with Standing in Nomenclature' (LPSN) and citing of LPSN. 2.6 Use of 'EzTaxon' for naming convention.	Lecture, Discussion
	3	3.1 Advances in Chemotaxonomy: the in-silico approach 3.2 Molecular chronometers in phylogeny: single gene & multigene sequence based microbial typing	Lecture, Discussion
	4	3.3 Advances in Genome relatedness Indices: • Various databases and their use in Whole genome comparisons. • Tree-building algorithms: distance-matrix methods, minimum evolution, LS, maximum parsimony, maximum likelihood and Bayesian inference	Lecture, Discussion

October	1	4.1 Omics in microbial systematics • Metagenomics • Metaproteomics • Metatranscriptomics • Metabolomics	Lecture, Discussion
	2	4.2 Microbial culture collections, Nagoya protocol, NBA and the National Biological Diversity Act for patenting of microbes. 4.3 Culture independent molecular methods for identifying unculturable bacteria • PCR • RFLP	Lecture, Discussion
	3	• ARDRA • DGGE • TGGE • RAPD	Lecture, Discussion
	4	•Microarray • FISH • RISA 4.4 Strategies for exploring ‘unculturable’ bacteria	Lecture, Discussion
November		Semester I Theory and Practical Examination	

Teaching Plan 2025 -26

Mrs. Priya V. Patil

M. Sc I Sem II

GENETICS AND MOLECULAR BIOLOGY

Month	Week	Topic covered	Teaching Method
December	2	1.1 Origin of life- aspects of prebiotic environment, evolution of the pre-cell. 1.2 Organic evolution: concepts and theories, mechanisms of speciation, genetic basis of evolution - Hardy-Weinberg genetic equilibrium, evolutionary clock.	Lecture, Discussion
	3	1.3 Molecular basis- genetic polymorphism and selection, coincidental and concerted molecular basis, gene duplication, sequence divergence, recombination and crossover fixation, pseudo-genes as dead ends of evolution 1.4. Origin and evolution of economically important microbes, plants and animals.	Lecture, Discussion
	4	1.5 Evidences for nucleic acids as genetic material 1.6 Organization of eukaryotic genetic material: Operon, Unique and repetitive DNA, Interrupted genes, gene families, structure of chromatin and chromosomes, heterochromatin and euchromatin. Polytene and Lampbrush chromosomes.	
January	1	2.1 Principles of Mendelian inheritance: linkage and gene mapping - Tetrad analysis, split and overlapping genes. 2.2. Law of DNA constancy and redundancy, C-value paradox, Cot curves and DNA re-association constant, dosage compensation, genetic load.	Lecture, Discussion
	2	2.3 Molecular basis of mitosis and meiosis	Lecture, Discussion
	3	2.4 Replication of DNA and duplication of chromosomes – modes and molecular mechanisms of DNA replication in prokaryotes (bacteria) and eukaryotes (nuclear and mitochondrial).	Lecture, Discussion
	4	2.5 Co-transcriptional and post-transcriptional processing of RNA, structure and stability of Mrna	Lecture, Discussion
February	1	3.1. Translation in eukaryotes – machinery, initiation, elongation, termination and release, posttranslational processing.	Lecture, Discussion
	2	3.2. Localization of proteins in cell - mechanisms of transport to nucleus, mitochondria, chloroplasts and outside the cell.	Lecture, Discussion
	3	3.3 Molecular mechanism of homologous recombination in bacteria and other organisms – RecBCD and Ruv systems, Holliday junction,	Lecture, Discussion

		interallelic, specialized and site specific recombination; Gene targeting.	
	4	3.4. Restriction and modification of DNA – enzymes, molecular mechanisms and significance.	Lecture, Discussion
March	1	4.1 Teratogenesis- chromosome aberrations, genetic disorders; Genetic counseling	Lecture, Discussion
	2	4.2 Transforming viruses, environmental factors causing cancer - carcinogens 2.2 Molecular mechanism and sequence of changes leading to oncogenesis - mutations, activation of proto-oncogenes, loss of function of tumour suppressor (anti-cancer) genes, role of apoptosis and telomere shortening in cancer.	Lecture, Discussion
	3	Techniques in molecular genetics: 4.3 Basic techniques - PCR, LCR, Nick translation, Blotting techniques – Southern, Northern and Southwestern blotting, colony hybridization	Lecture, Discussion
	4	Applications – 4.4 Chromosome walking, DNA foot printing and 16s rRNA sequence analysis 4.5 Transfection – Protoplast fusion, electroporation	Lecture, Discussion
April		Semester II Theory and Practical Examination	

Teaching Plan 2025 -26

Mrs. Priya V. Patil

M.Sc II Sem III

Medical Microbiology and Virology

Month	Week	Topic covered	Teaching Method
July	3	1.1 Emerging and Reemerging Infectious diseases: Types (NewNew diseases, New-old diseases, Old-new diseases, Old-old diseases) 1.2 Modern medicine as a source of New diseases	Lecture, Discussion
	4	1.3 Microbiota shift diseases 1.4Germ warfare	Lecture, Discussion
August	1	1.5 Concept of 'Opportunist' and 'Continuum' in the development of diseases	Lecture, Discussion
	2	1.6 Measuring Infectivity and Virulence: i) Animal Models: • Human volunteers • Non human •animal models	Lecture, Discussion
	3	• ID50 and LD50 • Tissue culture models • Organ culture models.	Lecture, Discussion
	4	2.1Colonization and Invasion of bacteria in host surfaces: • Penetrating Intact skin • Penetrating Mucin layer • Resisting Antibacterial peptides	Lecture, Discussion
September	1	• Adherence (Role of Adherence, pili and fimbriae, signal transduction, adhesins of Gram positive bacteria,Afimbrial adhesins) • SIgA Proteases • Iron Acquisition mechanisms	Lecture, Discussion
	2	2.2 Common means of colonization of respiratory viruses	Lecture, Discussion
	3	3.1. Bacterial Exotoxins: • Characteristics and Nomenclature • Exotoxin structure and Functions (A-B / Type III Toxins, Membrane disrupting/ Type II Toxins, Superantigens /Type I Toxins) • Secretion and Excretion of Exotoxins	Lecture, Discussion
	4	3.2 Exotoxin Induced Diseases • Diphtheria • Tetanus	Lecture, Discussion
October	1	• Botulism • Medical and cosmetic uses of bacterial exotoxins	Lecture, Discussion
	2	4.1. Emerging viruses challenging health management in India: • SARS-Cov-2 • Nipah	Lecture, Discussion
	3	• Zika • Kyasanur Forest Disease Virus (KFDV) • Adeno virus	Lecture, Discussion

	4	2. Fungal Diseases: Etiology, Clinical features, Pathogenesis, Laboratory diagnosis, Prevention and Control of, • Superficial Mycosis: Pityriasis • Subcutaneous Mycoses : Mycetoma • Systemic Mycoses: Mucormycosis	Lecture, Discussion
November		Semester III Theory and Practical Examination	

Teaching Plan 2025 -26

Mrs. Priya V. Patil

M.Sc II Sem IV

Enzymology and Enzyme Technology

Month	Week	Topic covered	Teaching Method
December	2	1.1 History and special properties of enzymes as catalysts 1.2. IUB system of nomenclature and classification of enzyme	Lecture, Discussion
	3	1.3 Specificity of enzymes: a. Types: - substrate and product, group or relative, absolute – stereochemical and spatial specificity b. Theories to explain specificity – Lock and Key and Induced Fit hypotheses	Lecture, Discussion
	4	1.4 Structure of enzymes: monomeric and oligomeric enzymes, Ogsten's experiment and the concept of the Active Site 1.5. Methods employed to identify functional groups in the active site – trapping of the intermediate, use of substrate analogues, modification of amino acid side chains, some common functional groups and amino acids, chemistry of the active site	
January	1	1.6 Co-factors in enzyme action: a. Organic – prosthetic groups, coenzymes and cosubstrates b. Inorganic – metal ions in enzyme function, metal activated enzymes and metallo-enzymes, ternary complexes	Lecture, Discussion
	2	2.1. Kinetics of single-substrate enzyme catalysed reactions - Wilhelmy's and Brown's work, Henri and Michaelis-Menten relationships, Briggs and Haldane assumption and derivation, Lineweaver- Burk, Eadie-Hofstee, Hanes and Eisenthal and Cornish-Bowden modifications of the M-M equation to derive KM, Significance of the M-M equation and KM	Lecture, Discussion
	3	2.2 Kinetics of multisubstrate reactions 2.3 Haldane's relationship for reversible reactions 2.4 Sigmoid kinetics – Hill and Adair equations for cooperativity	Lecture, Discussion

	4	3.1 Enzyme inhibition: basic concepts, kinetics, examples and significance of reversible and irreversible inhibition	Lecture, Discussion
February	1	3.2. Ligand induced conformational changes – basic concepts of allosterism and allosteric enzymes, models proposed to explain the mechanism of functioning (MWC and KNF); structural aspects of aspartate carbamoyltransferase, role of allosteric enzymes in metabolic regulation – feedback inhibition.	Lecture, Discussion
	2	3.3 Multienzyme systems – basic concepts, types with examples, structural and functional aspects of pyruvate dehydrogenase, fatty acid synthetase, 'Arom' complex and tryptophan synthetase	Lecture, Discussion
	3	3.3 Molecular mechanism of homologous recombination in bacteria and other organisms – RecBCD and Ruv systems, Holliday junction, interallelic, specialized and site-specific recombination; Gene targeting.	Lecture, Discussion
	4	3.4. Membrane bound enzymes in metabolic regulation 3.5. Isoenzymes – basic concepts, method of detection, examples and their metabolic significance.	Lecture, Discussion
March	1	4.1 1. Applications of enzymes in medicine: a. In diagnosis – general principles and use of alanine amino transferase, aspartate amino transferase, lactate dehydrogenase, creatine kinase, acid and alkaline phosphatase b. In therapy – specific applications of few selected enzymes, prodrug activation with examples, enzyme replacement therapy	Lecture, Discussion
	2	4.2 Industrial applications of enzymes – catalysts in the manufacturing and other conversion processes 3. Enzymes as analytical tools	Lecture, Discussion
	3	4.3 Immobilisation of enzymes: basic concepts, methods used, properties of IME and their applications in industry, medicine, enzyme electrodes	Lecture, Discussion
	4	Newer approaches to the application of enzymes – reactions in organic solvents	Lecture, Discussion
April		Semester IV Theory and Practical Examination	

Teaching Plan 2025-26

Dr. Vidya A Karande

M. Sc I Sem I

Biochemistry

Month	Week	Topic covered	Teaching Method
July	3	i. What is Biochemistry? ii. Goals of Biochemistry. iii. The roots of Biochemistry. iv. Biochemistry as a discipline and an interdisciplinary science. v. Biochemistry as a chemical science. vi. Biochemistry as a biological science. vii. New tools in biological revolution viii. The uses of Biochemistry.	Lecture, Discussion
	4	Common functional groups in biochemistry. OH, CHO, C = 0, NH2, C – NH2, SH, ester, ethers, methyl, ethyl, phospho, guanidio, imidazole etc)	Lecture, Discussion, Assignments
August	1	Common ring structures in biochemistry Isomerism. Isotopes. Energetics. Redox systems. High energy compounds.	Lecture, Discussion
	2	Nucleic acids: i. Tautomeric forms of bases and their implication in pairing of bases. ii. Structure of polynucleotides, DNA structure, DNA and RNA (t -RNA, r- RNA, m- RNA etc).	Lecture, Discussion
	3	Structure of DNA double helix. iv. R and L handed forms. v. A, B, C and Z forms of DNA. vi. Denaturation and Renaturation of DNA and Tm value.	Lecture, Discussion, Assignments
	4	Proteins: i. Structural features of amino acids, classification of amino acids, Amino acids as buffers, ii. Henderson Hasselbalch equation and its role in buffer formulation Peptide linkage, partial double bond nature of peptide bond	Lecture, Discussion

September	1	Determination of primary structure of polypeptide (N- terminal, C-terminal determination, method of sequencing of peptides), iv. Structural classification of proteins: primary, secondary, tertiary, quaternary structures of proteins. v. non-covalent interactions, Conformational properties of proteins, Polypeptide chain geometry, Resonance forms of the peptide group, cis/trans isomers of peptide group Ramachandran plot (Molecular visualization tools, Uniprot).	Lecture, Discussion,
	2	Secondary, Super-secondary Motif &Domain. vii. Tertiary and Quaternary structures of proteins, (Myoglobin &haemoglobin).	Lecture, Power point ppt
	3	Membrane transport: Overview of membrane transport. ATP powered pumps and intracellular ionic environment.	Lecture, Discussion,
	4	Non gated Ion channels and the resting membrane potential.	Lecture, Discussion
October	1	Co-transport – symport, antiport. Neurotransmitters. ATP driven active transport system for Sodium and Potassium ions. Proton gradient in Halobacteria. Transport of antibiotics that increase the ionic permeability of membranes. Co-transport – symport, antiport. Neurotransmitters. ATP driven active transport system for Sodium and Potassium ions. Proton gradient in Halobacteria. Transport of antibiotics that increase the ionic permeability of membranes.	Lecture, Discussion
	2	Carbohydrates: L forms and D forms of sugar. Reducing and non-reducing sugars. Aldoses / ketoses. Alpha and Beta, ring forms of sugars. Glycosidic linkages.	Lecture, Discussion, power point presentation

		Sugar derivatives – sugar alcohol, amino sugars, dextrose sugars, sugar acids Polysaccharides (starch, glycogen, cellulose)	
	3	Lipids: Fatty acids – Types and nomenclature. Saturated and unsaturated fatty acids,	Lecture, Discussion, power point presentation
	4	Structure and function of Triglycerides, Phospholipids, Sphingolipids. Structure and function of steroids, terpenes, prostaglandins.	Lecture, Discussion, power point presentation
November		Examination	

Teaching Plan 2025 -26

Dr. Vidya A Karande

N. Sc I Sem II

Quality Control in Pharmaceutical Sector

Month	Week	Topic covered	Teaching Method
December	2	Drug designing and development 15 Hrs Introduction to drug design, computer aided drug design, molecular modeling in drug design – structure-based drug design. General approach in novel drug discovery- new Lead molecule discovery–Lead molecule optimization, Lead molecule modifications– ADME properties of new drug molecule. Mechanism of drug action and its physiochemical principles- drug stereo chemistry, structure activity relationship.	Lecture, Discussion
	3	Comparative modeling of proteins– comparison of 3D structure – Homology – steps in homology modeling – tools (Modeler) –side chain modeling – loop modeling. 3D structure databases–molecular docking – (Auto Dock).	Lecture, Discussion
	4	Introduction to energy minimization, MD simulation, Setting up MD (System preparation- parameter files), equilibration, Analysis of MD-RMSD, RMSF, Radius of gyration.	PPT Online demo lectures
January	1	Microbial synthesis of pharmaceutical products and spoilage 15 Hrs Manufacturing procedures and in process control of pharmaceuticals products. Production of pharmaceutical products- by using microbial fermentations (Streptokinase, Streptodornase).	Lecture, Discussion
	2	Development of new vaccines- DNA vaccines, synthetic peptide vaccines, multivalent subunit vaccines, recombinant vaccine. Vaccine efficacy testing and its clinical trials. Microbial contamination and spoilage of pharmaceutical products (Sterile injectables, non-injectables,	Lecture, Discussion
	3	Quality assurance and product validation	Lecture, Discussion

		Good Manufacturing Practices (GMP) and Good Laboratory Practices (GLP) in pharmaceutical industry. Quality assurance and quality management in pharmaceuticals ISO 9000, series, practices of GMP WHO, and US certification. Drug stability: parameters for physical stability testing, solution stability, solid stability.	
	4	Sterilization control and sterility testing (For heat sterilization, TDP, TDT, D value, F value, z value,	Lecture, Discussion
February	1	survival curve, Radiation, gaseous and filter sterilization (Mention Tests). Chemical and biological indicators.	Lecture, Discussion
	2	Design and layout of sterile product manufacturing unit Designing of Microbiology laboratory, Industrial Safety:	Lecture, Discussion
	3	Assessment of risk, Industrial hazards and their prevention, fire, accidents, mechanical and electrical equipment's, industrial effluent testing, laboratory standards	Lecture, Discussion
	4	Records and documentations: Records related to products release, Quality review, and Quality audits. Complains and recalls.	Lecture, Discussion
March	1	Intellectual property rights and regulatory practices in pharma industries:	Lecture, Discussion
	2	Intellectual property rights, Introduction to patents. Regulatory aspects of quality control of pharmaceutical products. IP, BP, USP. Government regulatory practices and policies,	Lecture, Discussion, PPT
	3	FDA perspective. Reimbursement of drugs and biologicals, legislative perspective. Biosensors in Pharmaceuticals (Cholesterol oxidase). Application of microbial enzymes in pharmaceuticals.	Lecture, Discussion, PPT
April		Examination	

Teaching Plan 2025 -26

Dr. Vidya A Karande

M Sc II Sem III

Bioinformatics, Biostatistics and Bionanotechnology

Month	Week	Topic covered	Teaching Method
July	3	**Definition and components**, databases – definition, biological databases, types and examples, database management systems (DBMS)	Lecture, Discussion
	4	2. Applications of bioinformatics	Lecture, Discussion
August	1	3. **Data visualisation** – sequence and structure of nucleic acids and proteins, data visualisation tools.	Lecture, Discussion
	2	4. **Pattern matching and sequence alignment of nucleic acids and proteins** – fundamental principles of pairwise sequence alignment, local and global alignment, multiple sequence alignment, sequence alignment tools and databases.	Lecture, Discussion
	3	**Modeling and Simulation** – components and process of modeling and simulation,	Lecture, Discussion
	4	**Phylogenetic analysis:** basic principles and methods of preparation of phylogenetictrees.	Lecture, Discussion
September	1	**Biostatistics** **Basic concepts:** definitions – statistics and biostatistics, population, sample, variable and the various types, statistic and parameter	Lecture, Discussion
	2	Definition, Census, Vital statistics Population projection, Population growth and Estimation Vital statistics rate	Lecture, Discussion
	3	Algorithm – Monte Carlo, Metropolis,	Lecture, Discussion
	4	methods and tools used for proteins structure (secondary, motifs and domains).	Assignments
October	1	**Nanotechnology**: Basic concepts, definition, Historical background 2. **Synthesis methods**: Top-Down and Bottom-Up Approach Physical, chemical and biological synthesis methods,	Lecture, Discussion

	2	**Nanobiotechnology**- Introduction, Green synthesis- Microbial synthesis (Bacteria, Fungi, Algae, Virus)	Lecture, Discussion
	3	**Analysis of Nanomaterials**: Methods and characterization techniques-UV-Visible spectroscopy, FT-IR Spectroscopy, X ray Crystallography, Dynamic Light Scattering (DLS) spectroscopy, Zeta potential spectroscopy,	Lecture, Discussion
	4	Energy Dispersive X-Ray Analysis (EDAX), Transmission Electron Microscope (TEM), Scanning Electron Microscope (SEM), Scanning Tunneling Microscope (STM), Atomic Force Microscope (AFM)	Lecture, Discussion
November		Examination	

Teaching Plan 2025 -26

Dr. Vidya A Karande

M. Sc II Sem IV

Molecular Biology Tools and Applications

Month	Week	Topic covered	Teaching Method
December	2	1. Enzymes: restriction endonucleases, exonucleases – DNA and RNA; DNA polymerases, DNA ligases, alkaline phosphatase, terminal transferase, reverse transcriptase, 2. Linkers and adaptors 3. Cloning vehicles (vectors):	Lecture, Discussion
	3	Desirable features of ideal cloning vehicles Plasmids: - pUC, pBR322 and its derivatives, IncP-group, Viral based: - λ phage – basic and derivative vectors, M13, f1, fd	Lecture, Discussion
	4	other viruses - addition, self- inactivating, helper dependent and helper-independent Cosmids, phasmids, phagemids	
January	1	Specialist purpose vectors: - M13 based, expression, shuttle, gene inactivation, integrative, RNA probe and RNAi vectors, strong	Lecture, Discussion
	2	Artificial chromosomes: - BAC, YAC, PAC	Lecture, Discussion
	3	4. Gene probes: development and labeling of DNA and RNA probes	Lecture, Discussion
	4	promoter vectors, purification tag vectors, protein solubilisation vectors, secretion vectors	Lecture, Discussion
February	1	Basic Cloning Strategies General principles: DNA fragmentation, ligation to vectors, introduction into the host cell, cell based and PCR based strategies	Lecture, Discussion
	2	2. Cloning in *Escherichia coli* and other bacteria	Lecture, Discussion
	3	a. Construction of genomic libraries – Maniatis' strategy, EMBL 3A vector strategy	Lecture, Discussion, ppt
	4	Construction of complementary DNA (cDNA) libraries – Maniatis' hairpin-primed second-strand DNA synthesis, oligo-dC tail method, the Gubbler-	Lecture, Discussion

		Hoffman method, direction cDNA cloning, plasmid-linked cDNA synthesis, CAPture method	
March	1	Screening of gene libraries: hybridization, PCR, Immunochemical, Protein-protein interactions, Protein-ligand interaction, functional complementation, gain of function **4.** Expression of foreign DNA in transformed bacteria	Lecture, Discussion
	2	Cloning in Eukaryotes 1. Cloning in yeast and fungi: Vector systems: YEp, YCp, YAC, modular expression vector, yeast secretion vector (pGAP), introduction of DNA, selectable markers Heterologous protein production – source of DNA, level of heterologous RNA, amount of proteinproduced, nature of product	Lecture, Discussion
	3	Cloning in animals: Vectors systems: plasmid-based vectors - pSV2-dhfr, pRSV-neo, virus-based vectors - adenovirus, adeno-associated, baculovirus, herpes virus, retrovirus, Sindbis and Semliki Forest disease virus, vaccinia and pox virus, EB virus	Lecture, Discussion
	4	Cloning in Plants: Vectors systems: Ti plasmid of *Agrobacterium tumefaciens* and Ri plasmid of *Ag. Rhizogenes*, viruses – caulimovirus, geminivirus, BMV, TMV, PVX Cloning in Plants: *Agrobacterium*-mediated gene transfer, direct DNA transfer, gene targeting, *inplanta* transformation Applications of rDNA Technology	Lecture, Discussion
April		Examination	